

## TECHNIQUE FOR MEASURING PROJECT MANAGEMENT PRACTICES IN CONSTRUCTION INDUSTRY

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### ABSTRACT

Measuring success in project management performance is a challenge for the construction industry although project management (PM) has been practiced for thousand years with the pyramids, the Great Wall and the Stonehenge as the excellent examples. Many literatures are available on quantitative methods in PM measurement and improvement, yet less literature is available in qualitative methods. However, with the PM system in place, construction industry worldwide is still synonym with high-profile problems such as cost of project increases, late project delivery, poor quality, abandoned projects and major defective works. Therefore, this paper emerged with the aim of appraising the technique, a formal set of strategic performance measurement key performance indicators (KPIs) framework, so that it can be incorporated into the current construction PM practices. This aim can be achieved by identifying the current practice of PM in construction industry, examining the attributes of KPIs in construction industry in order to permit its elements to be implemented in the PM and proposing the supports from the KPIs team in ensuring the success of KPIs implementation in construction PM. Through literature review, the understandings on these matters are obtained. This paper proposes that KPIs should be incorporated into the PM in confronting the problematic issues within construction industry which consist of time, cost and quality in initiation, planning, execution and controlling, and closure stages. It is expected that this paper could assist the top management of respective construction companies to improve their current practice in PM by better understanding the elements of KPIs.

**KEYWORDS:** Performance Measurement, Project Management, Key Performance Indicators, construction Industry

### INTRODUCTION

Measuring success in business performance is a challenge for construction organization. There are many intelligence tools, techniques, methodologies and best practices being implemented for performance measurement in construction industry. Although construction project management has been used extensively in the construction industry, it is not an easy matter due to the complexity and dissimilarity of industries, which cannot be regarded as same practices. Therefore, construction industry is still synonym with high-profile problems such as cost of project increases, late project delivery, poor quality, abandoned projects and major defective works. It is alarming on the construction failure rate in the United States where data resource from Bizminor indicates that the number of contractors failures is doubled in between 2008 to 2009 from 15 percents to approximately 30 percents (New York County Lawyers' Association, 2011). As for Malaysia construction industry, According to the Construction Industry Development Board Malaysia (2008), 11,321 construction firms were classified as dormant and non-active from January 2006 to August 2008.

In worldwide, there are approximately 24 percent of projects being failed, cancelled or delivered but never can be used (Collaboration, Management and Control Solutions, 2009). In general, construction failure is usually the result of multiple causes. In early of the year 2009, The Surety and Fidelity Association of America (2009) in the review of 86 claims cases on failed of contractor, failed factors mainly on the unrealistic growth of the construction industry including significant increases in size of projects or expand rapidly, performance issues such as change in type and location of works, personnel issues including change of leadership or leaving of key staffs, accounting issues include inadequate cost tracking system, estimating or procurement problems and management issues such as a lack of training for personnel and inexperience with new types of works. Morris and Hough (1993) also provide lists of factors believed to contribute to the project management success or failure. For example, initial budgeting is one of the critical factors due to the high level of uncertainty in initial phase that may end with cost overrun and poor in quality.

Besides, having conferred the research on PM around the globe, none discusses the KPIs element in depth for PM practices performance measurement. Given that KPIs related to construction particularly the provision of PM has not been academically researched extensively, thus, in line with this negligence on construction related KPIs research in PM, this study that assimilates KPIs in PM is considered as solely unique with its practical research on cost, time, quality and customer's satisfaction performance measurement.

Therefore, there is a great need in the construction industry for identifying a set of common indicators to indicate the overall health of the construction project. This set of key performance indicators (KPIs) will make objectives quantifiable, providing visibility into the performance of construction organizations and enabling decision makers to take action in achieving the desired outcomes, developed via the involvement of various parties including the construction companies, government, members of the public, banking institution, insurer, etc. Hence, KPIs is one of the innovative measurement tool to be integrated in PM system for the entire project life cycle (PLC) on decision support for cross functional team. Construction executive and project managers must be cooperative in measuring construction performance at the project level as a part of achieving business strategy to deliver project on time, on budget, free from defects, efficient, right at the first time and safe. The measurement link organization's approach from vision to strategy, objectives, critical success factors and individual actions of the project is illustrated in Figure 1 (Bauer, 2004). The measurement can be either top-down approach for the records of management governance and accountability at management function level or bottom-up for functions and activities at operational function level for a specific operational nature.



**Source:** Edited from Bauer (2004)

**Figure 1: Measurement Link Organization's Approach**

## Project Management Practices

Application of construction project management (PM) is very difficult in functional areas, especially in resources factor like fund and people issues. A lot of organizations claims that PM is about execution on program management where there are always misconceptions about construction PM as a set of tools and techniques. Furthermore, most of the companies described on those project managers who can operate a software package on presentation, planning and controlling of a series of integrated tasks but not be empowered with authority or critical decision-making opportunities. However, management team always treat PM as a learning profession where managers with PM knowledge are not given the responsibility for capital projects, customer expectations, competitiveness, executive understanding, efficiency and effectiveness, new project development, survival and treat.

There are many literatures offering various definitions of PM. Among others is British Standards Institute (1996) that defines project management as “the planning, monitoring and control of all aspects of a project and the motivation of all those involved in it to achieve the project objectives on time and to the specified cost, quality and performance”.

Project Management Institution (2000) on the other hand defines PM as “the application of knowledge, skills, tools, and techniques to project activities to meet project requirements”, whilst Reiss (1993) suggests “a project is a human activity that achieves a clear objective against a time scale, and to achieve this while pointing out that a simple description is not possible, suggests project management is a combination of management and planning and the management of change”. Besides, Walker (2002) defines construction project management (CPM) as “the planning, co-ordination and control of a project from conception to completion (including commissioning) on behalf of a client that require the identification of the client’s objectives in terms of utility, function, quality, time and cost, and the establishment of the relationships between resources, integrating, monitoring and controlling the contributors to the project and their output, and evaluate and select alternatives in pursuit of the client’s satisfaction with the project outcome”.

Thus, based on these definitions, this study observes that the effective management of any PM can only be achieved when it can be measured against the customer’s satisfaction within realistic limits of cost, time and quality for the feasibly on completed project throughout the entire project life cycle development process phases within a company, particularly at the front-end of PM. It needs the combination of the soft man management skills (Daniel, 1990), as well as harder analytical tools (Yeo, 1993). On the other hand, it provides a workflow system that unites all team members in shared principles and practice. Therefore, if construction industry wishes to achieve excellence in PM, they need to have clear understanding of the PM practices.

## Front-End Project Management

The term ‘front-end of project management (PM)’ is the management of the projects at the beginning of the project. Morris (2011) reinstates that “if we want to be really effective in improving PM performance, we should therefore be focusing on the front-end”. Apparently, the front-end of PM practice appears to lack clear definition and effective guidance since the role is not well documented in the literature. Moreover, managing the front-end activities can be in different approaches for different types of construction project, for instance large construction companies (LCs) manages differently than medium sized companies (MSCs). Other example is the methods of procuring professional services where it can be the responsibilities of the financial planning consultants to evaluate the economic and financial feasibility, the architectural and engineering companies or the consortium as technical consultant, the design or construct companies in a

single organization and professional construction managers to offer professional services for entire project. Likewise, financing the constructed facility can be in different approaches for different types of project construction, such as residential housing, institutional and commercial building, specialized industrial, and infrastructure and heavy construction.

Therefore, the definition on the front-end of PM in this study is the management and assessment of the project in initiation phase, which commenced from an idea or concept and ended with final decision from the board that precedes the detailed planning in the pre-contract planning process by involving feasibility study, communication and reporting.

The scope of works involved in front-end phase are assessing the financial and technical viability of the project; establishing what funding arrangements assist needed in the project; examining the basic project proposal; establishing whether the project proposal is viable or not and developing the project proposal so that it is technically and financially feasible; preparing overall programme for total project and establishing a total time scale; selecting of the design team and terms of appointment; carrying out preliminary investigation on the site and examining alternative designs and layout; establishing optimum requirements regarding basic layout and constraints; obtaining necessary approvals from the government and other statutory bodies; carrying out site investigation such as topographical survey, soil reports, bore holes and other geological tests necessary for the design satisfaction and construction of the project; preparing preliminary architectural and engineering drawings and a preliminary material, workmanship and equipment specifications for the purpose of planning approvals and establishments of budgets; preparing a project budget with investment proposals including cash flow projections; defining basic building and structural requirements; establishing outline planning approval within the specified time frame; preparing a feasibility report outlining all aspects of the projects; and preparing initial information to gain exposures and publicity for the project (Poh, 2010). Feasibility study and reporting document are essential to be used at the front-end of project in order to communicate to the project manager or owner on the project mission and scope, and gain the project committee approval to allocate a budget and officially indicate acceptance, agreement and start date. Failure to establish budget, scope and support at the outset will invariably lead to project crisis at the later date.

Many literatures are available on quantitative methods in PM (Raz and Michael, 1999, Rolstadas, 2001), yet less literature is available in qualitative methods. Generally, qualitative or quantitative methods are the method used to perform the front-end performance assessment. Qualitative methods are used for conceptual definition and development, whereby quantitative methods are normally used in concept evaluations and detailed planning. The information is analysed from the collected data, and the resulting outcome provides the basis for the concept development on establishment of final decision to execute the project. Lack of information will result in decisions burdened with uncertainty (Wright and Ayton, 1987). However, any sophisticated analysis method relying on the end quality, not quantity of the in-put information as it influences the right decisions.

Apparently, abandoned project is considered one of the most common and serious problems in construction industry. Purchasers are the worst affected when a project is abandoned. A lot of people declared bankruptcy. At this point, it is apparent that significant percentage of those declared bankrupt are victims of abandoned projects. There are many causes leading to this problem. Root causes to projects abandonment can be categorized into: economic crisis, financial problems of developers, legal issues in obtaining project approvals and licenses, construction managerial, system-related factors, unforeseen risks and other causes, such as conflicts, feuds and non conformance with construction specifications.

Hence, this study emphasizes on the importance of the front-end PM whereby many research for instance Morris

and Hough (1991), and Kharbanda and Pinto (1996) conclude that the unsatisfactory project results are often at the front-end phase, and there is a need for improved PM in housing investment project. In addition, UK Association for Project Management (2006) reviews the analysis of project success and failure by Morris and Hough (1987) on the finding as aforesaid. Ultimately, the factors affect the project such as unclear objectives, changing sponsor strategy, poor project definition, technology difficulties, inadequate manpower and geophysical conditions are very much beyond than what has been identified in the Project Management Body of Knowledge (PMBOK) model. Morris (2009) continues to stress the importance of the front-end PM for the project. Similarly, Meier (2008) also concludes that most unsuccessful programs fail at the beginning.

### **Understanding of Key Performance Indicators**

KPIs have been invented and branded by Business Intelligence (BI) as “benchmarking” (Parmenter, 2007 and Peterson, 2007). Since then, various models of KPIs have been adopted around the globe with different levels, such as European Foundation for Quality Management excellence model, balanced scorecard model and key performance indicators model. With such successful implementation, KPIs have been re-defined by BSRIA (2003) as qualitative or quantitative measurement of the activities of a project or organization towards its objectives. Constructing Excellence (2007) on the other hand defines construction KPIs as “national data sets against which a project or a company can benchmark its performance”.

As claimed by Parmenter (2012), KPIs represent a set of measures focusing on those aspects of organizational performance that are the most critical for the current and future success of the organization” where “very few organizations really monitor their true KPIs, because very few have explored what a KPI actually is”.

There are many researchers propose on the rule of performance measures too. Kaplan and Norton (1996) recommend no more than 20 KPIs, whilst Hope and Fraser (2003) suggest less than 10 KPIs. However, Parmenter (2010) prefers the 10/80/10 rule of performance measures which consisting of 10 key result indicators (KRIs), 80 result indicators (RIs) and performance indicators (PIs), and 10 KPIs in an organization. KPIs are the metrics quantifying the performance through control process. Given that KPIs are also the systems of parameters or way of quantitative and periodic assessment of a construction process that is to be measured, along with the procedures to carry out such measurement and the interpretation of the assessment in the light of previous or comparable assessments. Despite that KPIs tell the users what to do to increase performance dramatically as “what gets measured gets done” in the work processes, each measure typically provides a mechanism to determine results to date and predict future outcomes. It provides a means to focus managerial attention on critical areas and compare actual results with expected results.

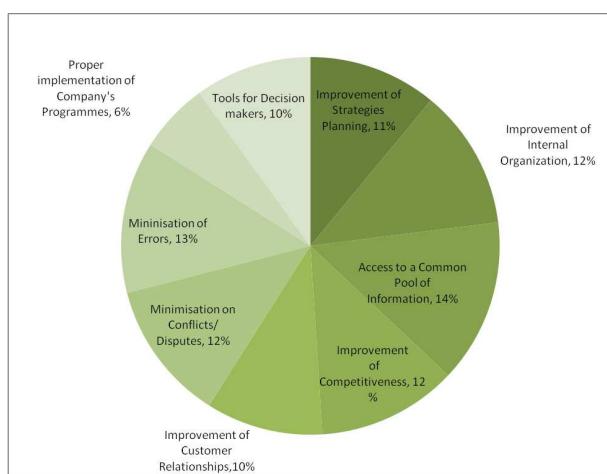
Moreover, metrics indicate problems and drive the analysis of what is causing it. As described by Hammer (2007), “a metric must be carefully and exactly well defined, so that there can be no doubt or dispute about it”. Hence, KPIs are metrics that had been proven in the United Kingdom (UK) and the US as the most reliable and accurate tool in monitoring performance. For example, Keller Group, a constructor from UK with a collaborative approach to customer relationships, implements KPIs as KPIs are competent in highlighting organisation and project weaknesses (Constructing Excellence, 2004). Based on the research undertaken by New Zealand The Centre for Advanced Engineering (CAE)(2005), many construction companies are profitable and obtain excellent reputation in adopting KPIs performance measurement which have been proven effectively and efficiently in delivering project on time, on budget and free from defect.

Therefore, there are many reasons behind the implementation of KPIs in business areas. Construction industry uses PIs in benchmarking of their performance, for instance benchmarking the organization performance against other organizations. However, construction industry is still doubtful on KPIs' performance management mode due to its practicability as well as cost and time of creating and utilising the integrated KPIs database. On the other hand, based on the claim that KPIs are not measurement friendly tool, this is used for assignment of blame and subsequent punishment. Moreover, KPIs can also lead to perverse incentives and unintended consequences as a result of employees working to the specific measurements at the expense of the actual quality or value of their work.

In view of all these, although knowing what needs to be measured is important, finding the right way to do is more difficult. In order to successfully implementing KPIs in the construction industry, Anderson (1996) and the United States Airforce (1991) conclude that KPIs particularly on the measurement and reporting mechanisms should be acceptable; meaningful to industry; simple and easy to use, understandable and logical; repeatable; show a trend over time; suitable for different areas or the company; feasible and economical to collect ; effective and are unambiguously defined; aligned; timely and drive appropriate action.

### Advantages of Implementing KPIs

A KPI will "tell you an action that needs to take place" (Parmenter, 2007). If a KPI has been correctly assigned to an organization, it will have a "flow-on effect" which will in turn benefit the company (Parmenter, 2007). The entire organization can monitor and fix problems associated with the success rate of the company's KPIs. The application of KPIs provides business executives with a high-level, real-time view of the progress of an organization in delivering project efficiently on time, safe, free from defect and on budget, such as the case study of Greek tanker shipping companies (Katerina *et al.* 2012) that provide benefits provided to KPIs user as illustrated in Figure 2.



**Source:** Katerina *et al.* (2011)

**Figure 2: Benefits of KPIs in the Tanker Shipping Company**

Therefore, amongst the benefits of using KPIs measurement is due to its ability in benchmarking the organisation performance against other industry or organisation, where the lessons learned from the best can be exploited to make targeted improvement. Given that KPIs are available as the project progresses, once the movement from one project milestone to another is undertaken, the management will immediately be able to see the performance level on the particular phase against the national average and will instantaneously act in improving the project in later phases.

Currently, KPIs are proven as the most reliable and accurate tool in monitoring performance in comparison with other manual surveys, which are time, money and energy consuming in its production and assessment. Based on the research undertaken by New Zealand The Centre for Advanced Engineering (CAE) (2005), KPIs are being exclusively adopted by New Zealand industry players in construction in place of other performance measurement methodology as the KPIs are proven to fulfil their potential clients' need, namely requiring their projects to be delivered on time, safely, free from defect, on budget and efficiently by profitable and excellent reputation construction companies.

There are significant benefits of applying KPIs in construction industry, which include benchmarking the organization performance against other industry or organization, the management will be able to see the moment of the project progress on the particular phase from project milestone which makes operations more flexible than competitors, such as the lead time needed to order supplies, competency in highlighting organization and project weakness as well as capable of being eyes and ears for management and staffs that lead to savings opportunities in operations. Moreover, it is an automated base via Microsoft Excel, Microsoft Access and SPSS with self developed data without needing manual close-monitoring by manpower as it is illustrated in graph or chart instead of in wordy report.

In addition, the time consumed in benchmarking is minimised due to visual metrics. With the common exercise in KPIs practice, it will streamline the entire organization reputation as it links employee rewards and sanction to performance measured against the KPIs. Furthermore, it professed by the construction industry players who calculate their organization or project benchmark score from metrics of the entire organization and project. It focuses on deliver project efficiently on time, free from defect and on budget. KPIs fulfill the organization needs as it permit intense focus and scrutiny that drives improvement within the organization and project. More importantly, KPIs are the tool for assisting all levels in the organizations to gauge the current performance and success rate of a particular operation to increase efficiency, boost performance, enhance sales and assist in budgeting.

## DEVELOPED KEY PERFORMANCE INDICATORS

Based on the aforesaid literature review, KPIs can be developed in construction industry to measure their project management (PM) practices performance. Each performance indicator can be measured, either quantitatively or qualitatively. The PM performance includes both financial and nonfinancial measures. Factors on cost, time, quality and customer's satisfaction are the four perspectives that taken into consideration.

However, this paper proposes that construction KPIs demonstrate and measure the cost, time and quality aspects for the customer satisfaction of project construction organizational performance monitoring. These include organization and management in the total project life cycle (TPLC) phases from pre-construction phase to post-construction phase, which involve preparatory, procurement, contract award and contract management in pre-operational (design, construction and commissioning) as well as operational phase, the most critical component determining the deliverance of the project or asset.

The management of KPIs engages seven steps as shown in Figure 3. The first step is to determine the areas to measure by selecting KPIs that meet the needs of the company and its client. The second step initiates with data collection which advise and guide the gathering of realible data that is tally with the national definitions. The third step is to transform data into information that can be benchmarked, where a typical initiation time calculated KPIs is shown in Table 1 and Figure 4.

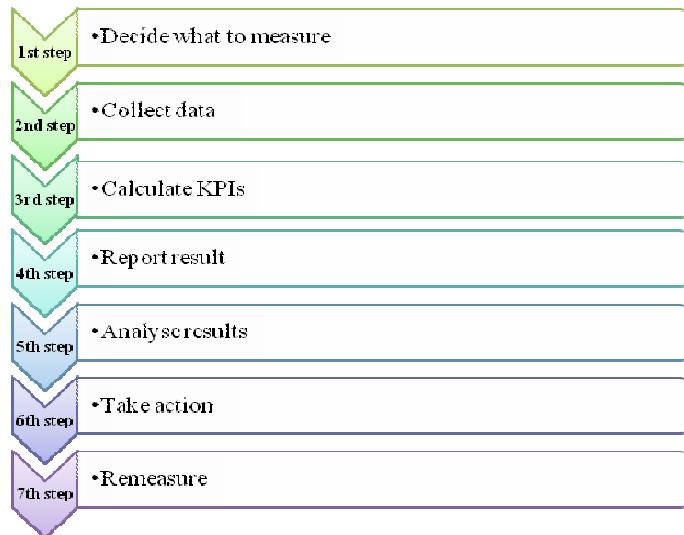


Table 1: Example of Typical Initiation Quality Calculated KPIs

Initiation's Quality (Cycle from 0° To 90°)					
Item	Description	KPIs (Initiation-Quality) as at Sept 2014	Quality		Unit
			Original	Actual	
1	Construction GFA	10.18	1,130,000	1,150,000	m <sup>2</sup>
2	Number of floors	9.38	32	30	Flr
3	Nett Lettable area	9.38	45,300	42,500	m <sup>2</sup>
4	Efficiency	9.25	40	37	%
5	Company's image (Public Survey)	7.00	10	7	%
6	Project feasibility	9.00	10	9	%
7	Finance Institution (Respond)	8.33	6	5	%
8	Proposed Selling Price (Survey)	7.00	10	7	%
<b>Ave. KPIs</b>	<b>Initiation – Quality</b>	<b>8.69</b>			

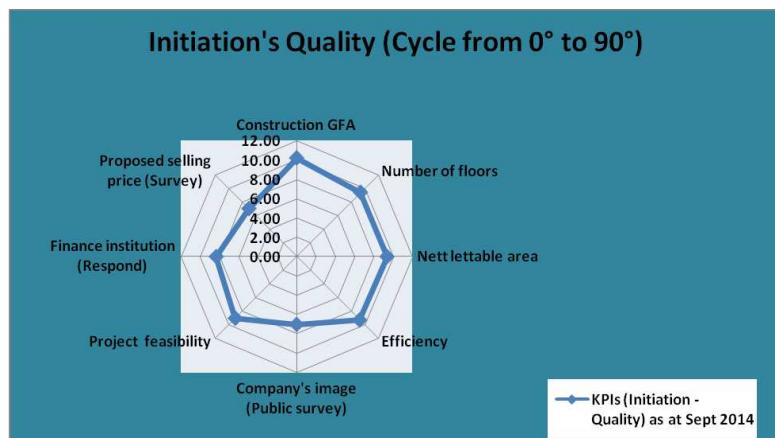


Figure 4: Example of Typical Initiation Time KPIs Chart

The KPIs input calculation then leads to the forth step of storing the results by the project or organization based on the desired objectives by producing the charts and reports in reference with the prior calculated result. An easily understood typical initiation quality chart is shown in Figure 5 using scoring system from 1 to 10, which score 1 means totally dissatisfied, score 5 or 6 means neither satisfied nor dissatisfied and score 10 means totally satisfied. The results demonstrate that well reported results will show where the strengths and weaknesses are laid in the fifth step. The action taken under the sixth step for the whole purpose of the performance management system is to improve the performance. Finally, the whole processes must be measured again whilst establishing KPIs as an integral part of the project for continuous improvement. KPIs should tell the management about what action needs to be taken and to prevent a recurrence for current and future success of the construction organizational. However, a lot of KPIs has been mislabeled and misused due to lack of focus and alignment and as well as under achievement.

## SUPPORT FROM PM-KPIS TEAM FOR THE SUCCESS IMPLEMENTATION

In achieving the effectiveness and efficiency on the implementation of KPIs for construction PM practice, total commitment from top management and at all levels of organization are needed. Forming a KPIs steering committee as shown in Figure 5 is essential. The team members consist of manager from eight functional departments which are project consultants, property, finance, construction, contract, purchasing, quality and safety and human resource. They are the facilitators in monitoring the results of the implemented KPIs in materialising the objectives of the company without argument. In pursuing and justifying the goals on the requirement for KPIs implementation, they need exercise on KPIs tools via training to develop understanding on the process approach in collecting, presenting and analysing data for benchmarking. To ensure success in developing an operating procedure, they need to support KPIs participants and represent an opportunity for interim improvement. However, KPIs team are required to integrate all functional departments in finding what to do in critical aspects to increase organization performance, understand the uses and benefits of an organization's measuring, monitoring and analytical processes by using KPIs for problem-solving and decision making.



Figure 5: KPI Team Members

To achieve higher level of employees performance, team needs to create a healthy working environment by providing teambuilding activities; selecting leaders to motivate subordinates in which they are doing things differently from the way things used to be done; motivating all employees to participating the whole process of KPIs implementation with reward and recognition system; informing the latest success KPIs by publicizing through company's newsletter, meetings, videos playing, bulletins, the intercom system and so on. As mentioned by Rowden (2001), implementation problems will continue to occur if the organization as a whole is not ready for change. Therefore, the whole company organization must understand and recognize the benefits of KPIs for PM practices especially to sustain in this complex and competitive industry.

## CONCLUSIONS

This paper has successfully achieved its aim of appraising key performance indicators (KPIs), a formal set of strategic performance tool that can be incorporated into the current PM system to meet the objectives of the construction management. KPIs in construction industry have been determined in permitting its elements such as decision on what to measure, monitor the true KPIs, measure time, cost and quality aspects for the customer satisfaction in total project life cycle phases in which to be implemented in the PM system. On the other hand, the actions and supports that should be initiated by the KPIs teams have been proposed by this paper in ensuring the success of KPIs implementation in PM system. Further studies especially on the development of the KPIs for PM practices within construction industry are expected to be carried out where this paper stands as a stepping stone for KPIs to be incorporated into PM system.

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